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**(54) A REVOLUTION COUNTER FOR A NUMBER WHEEL IN A METER**

20    **(Abstract)**

Disclosed is a revolution counter for a number wheel in a metering device, in which it can be easily attached to the existing meters to thereby provide a remote-reading system therefor.

25    The revolution counter comprises: a reflective plate attached to the outer face of the number wheel of the metering device and revolving along with the number wheel; a light emitter radiating a light toward the number wheel; a light sensor for counting the revolution number of the number wheel by sensing the reflected light by the reflective plate; a housing capable of being coupled to the metering by means of a coupling means such that the light emitter and the light sensor are disposed in the inner face thereof facing the number wheel having the reflective plate attached thereto, wherein the area corresponding to the remaining number wheels other than the one with the reflective plate attached thereto is transparent so as to be able to read their numbers.

35    Representative Drawing

FIG. 3a

Key Words

Meter, remote measurement, count, rotation times, reflective plate, light sensor, magnetic material, magnetic sensor

40    **(Specification)**

(Brief Description of the Drawings)

FIG. 1 shows a conventional meter (gas meter) where the present invention can be applied;

45    FIG. 2 is a perspective view of a revolution counter according to one embodiment of the invention;

FIG. 3a is a perspective view of an installed state of the revolution counter with a conventional meter;

FIG. 3b is an elevational view showing an installed state of the revolution counter with a conventional meter;

FIG. 4 shows a cross-section taken along the line A-A' in FIG. 3b, which illustrates a mechanism for the revolution counter of the invention.

5                   <Description of Major Components in the Drawings>

11: Number wheel                   11a: Lowest-digit number wheel

12: Cover of number plate       20: Reflective plate, or Magnet

10                   21: Housing

22: Light emitter and sensor, or Magnet

22a: Light emitter

22b: Light sensor

23: Coupling means

15                   (Detailed Description of the Invention)

(Object of the Invention)

(Field and Background of the Invention)

The present invention relates to a revolution counter of a number wheel in a meter, more specifically to such a revolution counter, in which it can be easily attached to conventional existing meter to thereby construct a remote-reading system therefor.

20                   A provider for utility, such as electricity, gas or water, charges a fee in proportion with the amount of utility consumed by a customer. In order to charge the fee, the provider must periodically read the meter to determine the amount of consumption of supplies for each customer. Mostly the utility meter is installed inside the customer's house. Therefore, a meterman must enter the customer's house to directly read the meter, or may be informed of the 25 reading from the customer, outside of the house without entering the house. In any case, the meterman must visit each customer's house.

30                   Thus, the present inventors have invented a remote-reading system of a meter, which is able to determine the amount of consumed utilities without necessity of visiting each customer's house, and which has been filed as Korean Patent Application No. 1999-0012705. In this invention, a reflective plate for reflecting a light is attached to a certain place of the last number wheel in a meter, and a light is radiated toward the reflective plate. Every time when the number wheel rotates, the radiated light is reflected by the reflective plate. Then, using a photosensor, the frequency of light-reflection can be counted and transmitted to the utility provider via a wire or wireless communication line. Instead of the reflective plate and the photosensor, a magnet 35 and a magnetic sensor may be employed for the same purpose. Therefore, the provider can remotely collect information on the amount of consumption for the customers, which are distributed over a wide area, so that a time and efforts to read the meters can be greatly saved. Also, the above remote-reading system can be applied to and used with the already-installed utility meters without changing the basic structure thereof, except for attaching a reflective plate 40 or a magnet to one of the number wheels.

(Object of the Invention)

It is an object of the invention to provide a revolution counter device of a number wheel in a meter, in which it can be easily applied to the existing meter to thereby practice Korean Patent Application No. 1999-0012705 in order to construct a remote-reading system therefor.

45                   Construction and Operation of the Invention

In order to accomplish the above object, the revolution counter device of the invention comprises: a reflective plate attached to the outer face of the number wheel of the meter and revolving along with the number wheel; a light emitter radiating a light toward the number wheel; a light sensor for counting the revolution number of the number wheel by sensing the reflected light by the reflective plate; a housing capable of being coupled to the meter by means of a coupling means such that the light emitter is disposed in the inner face thereof facing the number wheel having the reflective plate attached thereto, wherein the area corresponding to the remaining number wheels other than the one with the reflective plate attached thereto is transparent so as to be able to read their numbers.

According to the invention, a magnetic sensor can be employed instead of the light sensor. In this embodiment, the revolution counter device of the invention may include a magnet attached to the outer face of the number wheel of the meter and revolving along with the number wheel, a magnetic sensor for counting the revolution number of the number wheel by sensing the magnetic field generated by the magnet; and a housing capable of being coupled to the meter by means of a coupling means such that the magnetic sensor is disposed in the inner face thereof facing the number wheel having the magnet attached thereto, wherein the area corresponding to the remaining number wheels other than the one with the magnet attached thereto is transparent so as to be able to read their numbers. This embodiment is different from the case of using a light sensor in that a magnet is attached to the outer face of the number wheel of the meter and revolved along with the number wheel, a magnetic sensor is provided for counting the revolution number of the number wheel by sensing the magnetic field generated by the magnet, and thus a light emitter is not needed.

The preferred embodiment of the invention will be hereafter described with reference to the accompanying drawings.

As shown in FIG. 1, the conventional meter includes plural cylinder-like number wheels 11 and a transparent cover 12 disposed above the number wheels. The consumption is indicated by a series of numbers displayed in front of the rotating number wheels.

The revolution counter of the invention is constructed such that it can be installed above the conventional meter in a way of covering the number wheels thereof, as shown in FIG. 2, which shows an exterior of the revolution counter device of the invention. FIG. 3 shows a conventional meter with the revolution counter device of the invention installed therein, in which a light emitter and a light sensor, or a magnetic sensor 22 is placed facing the lowest-digit number wheel 11a with a reflective plate or magnet 20 attached thereto. The reflective plate or magnet 20 is attached to the lowest-digit number wheel 11a since generally the number indicated by the lowest-digit number wheel is not used in determining the amount of consumed utility.

The mechanism of the revolution counter for the number wheel according to the invention will be explained, in conjunction with FIG. 4, which shows a cross-section taken along the line A-A in FIG. 3.

When the light emitter 22a is supplied with an electric power, it radiates a light toward the lowest-digit wheel 11a. For every single rotation of the number wheel, the light is reflected by the reflective plate 20 and the reflected light is detected by the light sensor 22b, so that the revolution number of the number wheel can be counted. Here, the reflective plate 20 is attached to the outer face of the number wheel, and is preferred to have a good optical reflectivity and a smooth surface to avoid irregular reflection. The light emitter 22a may be constituted, for example, of a light emitting diode (LED). The light sensor 22b functions to sense and convert the reflected light into an electrical signal in order to count the number of times, and may be formed of a phototransistor. The light emitter and the light sensor 22 are supplied with a driving

electric power through a cable (not shown). The light emitter radiates continually lights toward the number wheel, and the number wheel is not rotated when the customer does not use the supplies. The light sensor 22a counts the revolution only when the light reflected by the reflective plate 20 is sensed by the sensor 22a. That is, if the light from the light emitter is radiated on the portion of the number wheel that the reflective plate is not attached, it is mostly absorbed by the number wheel and partly reflected irregularly, so that it cannot be detected by the light sensor. In case where the reflective plate reflects the light while it does not rotate, i.e., the reflective plate is placed facing the light sensor when the customer stops the use of supplies, the light sensor continuously senses the light, but the revolution number of the number wheel can be accurately counted by counting the number of times of light-rising.

In case of using a light sensor, the area where the light emitter and sensor 22 are disposed is preferred to be opaque or translucent in order to prevent the external light other than from the light emitter from being reflected on the reflective plate, which leads to malfunction of the device. The area facing the number wheels where the reflective plate is not attached is transparent so that the amount of consumption can directly be read by naked eyes.

In case of using a magnetic sensor, a magnet is attached to a certain position of the lowest-digit number wheel, and the revolution number of the number wheel can be determined in such a manner that a magnetic sensor senses an increase in the intensity of magnetic field every time when the number wheel is rotated. Here, the magnet 20 is preferred to be a permanent magnet.

The magnetic sensor 22 functions to detect the change in the magnetic field when the revolving magnet 20 approaches thereto, and may be any type of magnetic sensor as long as it has the above function. Examples for use as the magnetic sensor are an induction coil for inducing an electromotive force by the periodic change of interlink magnetic flux; a magnetoresistor for converting the intensity of magnetic field into a change of resistance and sensing the magnetic field as a change in the magnitude of current; a reed relay magnetically opening and closing a contact point sealed inside a glass tube; a hall generator, i.e., a semiconductor element for converting the magnetic field into an electromotive force using the Hall Effect; and a magnetodiode, i.e., a semiconductor element for varying or controlling an electric current by changing the intensity of magnetic field.

When the lowest-digit number wheel is not rotated, i.e., does not produce a magnetic change, the magnetic sensor does not count.

While the present invention has been described with reference to several preferred embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications and variations may occur to those skilled in the art without departing from the scope and spirit of the invention as defined by the appended claims.

#### (Effect of the Invention)

According to the invention, a remote-reading system of meter (Korean Patent Application No. 1999-0012705) can be practiced by a simple installation, in which a reflective plate or magnet is attached to a certain position of a number wheel and a housing is disposed on the cover of number wheels and fixed thereto. That is, the remote-reading system can be easily applied to the existing or already-established metering device.

#### 45 (57) Claims

1. A revolution counter for a number wheel in a metering device comprising: a reflective plate attached to the outer face of the number wheel of the metering device and revolving along

- with the number wheel; a light emitter radiating a light toward the number wheel; a light sensor for counting the revolution number of the number wheel by sensing the reflected light by the reflective plate; a housing capable of being coupled to the meter by means of a coupling means such that the light emitter and the light sensor are disposed in the inner face thereof facing the number wheel having the reflective plate attached thereto, wherein the area corresponding to the remaining number wheels other than the one with the reflective plate attached thereto is transparent so as to be able to read their numbers.
- 5           2. A revolution counter according to claim 1, wherein the light emitter includes a light emitting diode (LED).
- 10          3. A revolution counter according to claim 1, wherein the light sensor is formed of a phototransistor.
- 15          4. A revolution counter according to claim 1, wherein the revolution counter includes a magnet attached to the outer face of the number wheel of the metering device and revolving along with the number wheel, and a magnetic sensor for counting the revolution number of the number wheel by sensing the magnetic field generated by the magnet.
- 20          5. A revolution counter according to claim 4, wherein the magnet includes a permanent magnet.
- 25          6. A revolution counter according to claim 4, wherein the magnet sensor includes an induction coil for inducing an electromotive force by a periodic change of interlink magnetic flux; a magnetoresistor for converting the intensity of magnetic field into a change of resistance and sensing the magnetic field as a change in the magnitude of current; a reed relay magnetically opening and closing a contact point sealed inside a glass tube; a hall generator, i.e., a semiconductor element for converting the magnetic field into an electromotive force using the Hall Effect; and a magnetodiode for varying or controlling an electric current by changing the 30 intensity of magnetic field.